TECHNICAL ABSTRACTS

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Small HF Loop Antennas

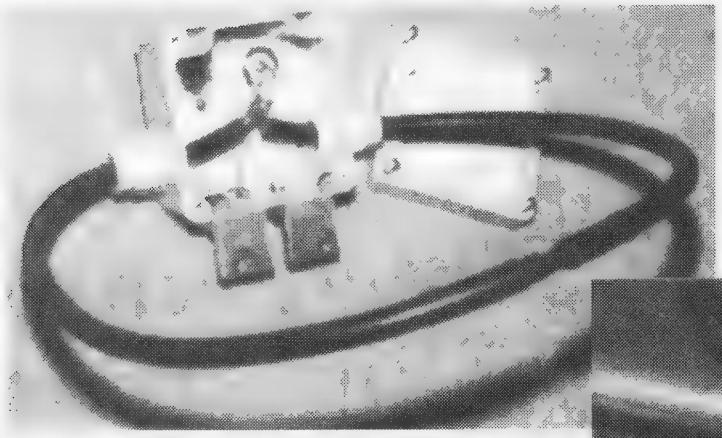
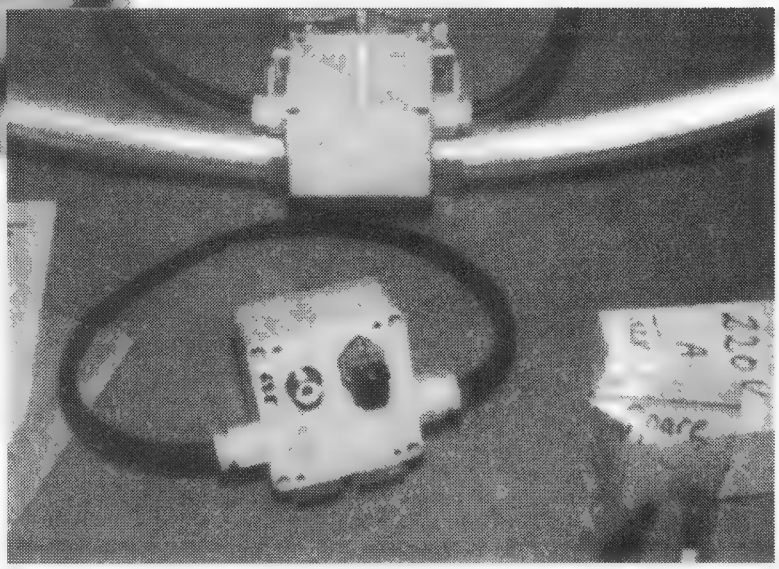


Fig 1. Original Loop of Patterson and the AMA Loop.



Loop antennas which are small with respect to the wavelength have been available from a number of sources. In the USA the AEA and MFJ products are well known and have been available in Australia. The German AMA series may be less well known but does offer a range of loops. The loops are often only a metre or so in diameter but there are versions which are two and three metres in diameter. The compact size of these antennas makes them attractive in many applications. They do have some limitations along with most small antennas.

IN THE JAPANESE magazine CQ Ham Radio September 1999 a survey of the small loop antenna was conducted by JG1UNE. A lot of information was presented but much of this is in Japanese. However there was some information which is of interest to those contemplating such an antenna.

The small loop first came to notice in an article in the magazine Electronics 21st August 1967 in an article by K Patterson describing some work on an army antenna. This was followed in QST May 1968 with an article by L McCoy. In the 1980's some articles appeared in CQ DL and Ted Hart W5JQR published an article in QST June 1986. In 1993 J Belrose VE2CV published an article in QST November 1993 which provided some details of his work with some loops.

There are a number of problems with transmitting small loops. They present some difficulties in efficient matching and their efficiency is low. The tuning components are highly stressed with high RF voltages and high circulating currents which can lead to losses and flashovers particularly if any more than modest powers are involved.

The bandwidth of the antenna is small and this must be so if any efficiency is being achieved in the structure and the matching.

The original loop described by Patterson in 1967 and the AMA loop of Chris Kaeferlein DK5CZ and Hans Wurtz DL2FA are shown in Fig 1. These differ in the tuning and matching. The earlier design used an arrangement of capacitors for the tuning and matching. This put quite stringent requirements on the capacitors and their connections if efficiency was to be achieved. The later design uses a coupling loop for matching and a separate tuning capacitor. The matching is easier and the tuning capacitor connections are simpler. The tuning capacitor must still cope with high RF voltages and large circulating currents. The Q is high and the bandwidth is quite narrow.

Table 1.

Type AMA	Diam m	Band m	dBD	dBi	Q	VSWR2 2:1 BW +/- Khz
4	3 4	160	-10 17	-8.02	3436	2
		80	-3 13	-0.98	2485	5.3
		40	-0.17	1 44	542	14
8	1 7	80	-9 44	-7 92	3969	2.1
		40	-2.49	-0 34	2459	4.3
		30	-1.08	1.07	1133	12
		20	-0 62	1 53	472	17
10	1 3	40	-4 18	2.03	3483	4.1
10D		30	-1.8	0.35	2001	9
		20	-0.89	1.26	927	10
		17	-0.6	1.55	457	17
		15	-0 52	1.63	299	18
13	0.8	80	-18 00	15 85	3635	2
		40	-8 82	-6 67	4469	3.2
		30	-4 63	-2 48	3906	6
		20	-2.23	-0.08	2549	10
		17	-1.23	0 92	1483	17
		15	-0 91	1.24	1023	18

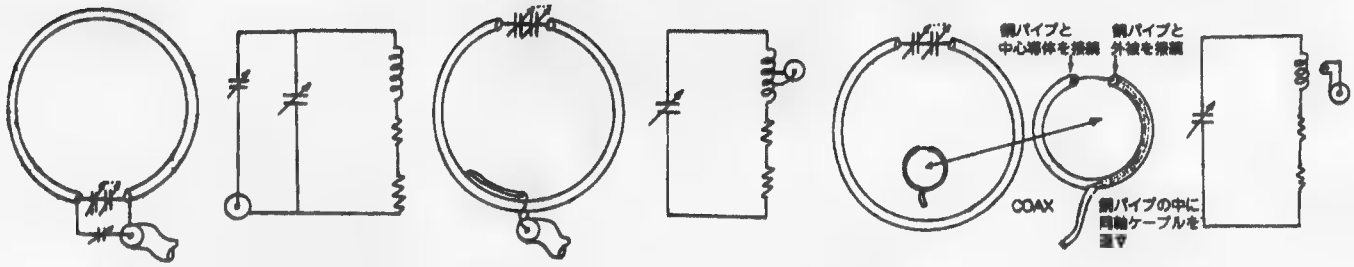


Fig 2.Three Loop Arrangements from W5QJR.

In Fig 2 which is the work of Ted W5QJR three different tuning and matching systems are shown. A plot of bandwidth against frequency for three loop sizes is shown in Fig 3. This is from the work of Jack VE2CV. The narrow bandwidth can be seen and the advantage of larger loop sizes at the lower frequencies is also shown.

The gain of four sizes of AMA loops is shown in Fig 4. The gains are largely negative where the loop has a circumference much less than the wavelength. A full wave loop is used in the Quad antenna. The gain is given in dBi which is dB relative to an isotropic radiator. A dipole has a gain of 2.15 dB relative to an isotropic radiator. Remember that short whip antennas also have negative gain due to losses.

The performance of some AMA loops is given in Table 1. These loops are made in Germany. Information can be obtained from Dipl. Ing. Christian Kaeferlein, D-64285 DARMSTADT Weinbergstrasse5 Germany (FRG). Tel +49-6151-61271. E-mail: kaeferlein-elektronik@t-online_de .

The AEA and MFJ loops have been available at times in Australia and you should try local distributors.

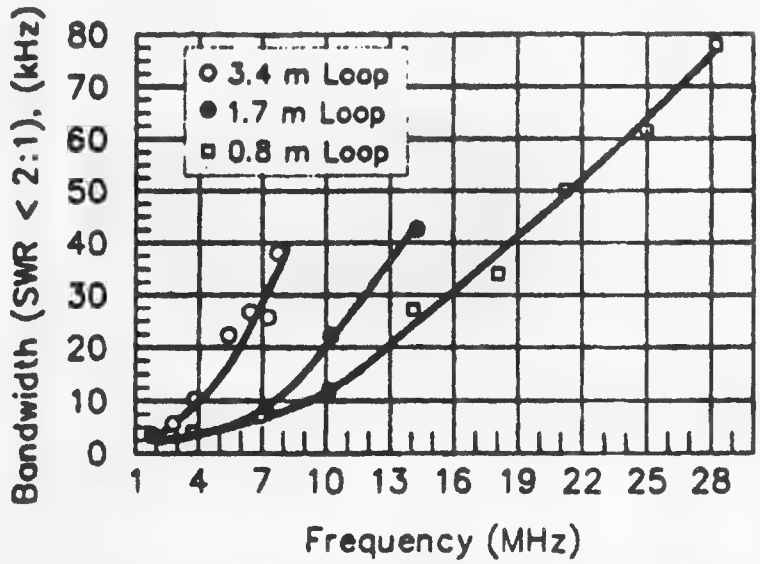


Fig 3. Loop Bandwidth with frequency from VE2CV.

RF Voltage Probe

A useful piece of equipment when working on RF circuits is an RF voltage probe. This enables RF voltages to be measured and displayed on an ordinary multimeter or digital voltmeter. An analogue meter is useful as it will allow easy peaking of circuits. However a digital meter will do particularly if it has a bar graph facility.

A simple and effective RF Voltage Probe appeared in the Technical Topics column of Pat Hawker G3VA in Rad Com October 1999. The item came from John A Share G3OKA.

The circuit and the simple circuit board are shown in Fig 5. The component leads

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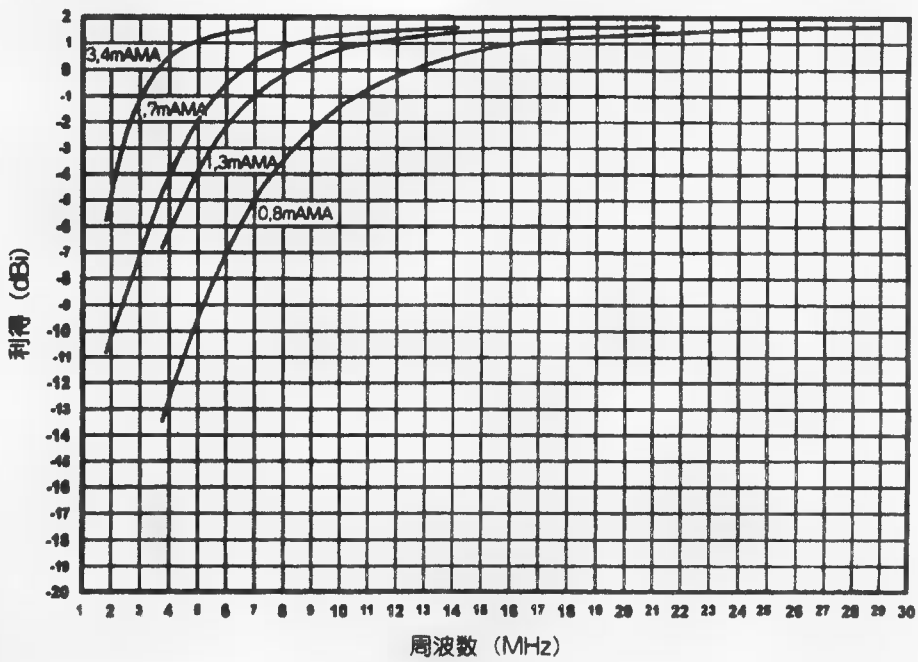

Fig 4. Gain in dBi of AMA loops.

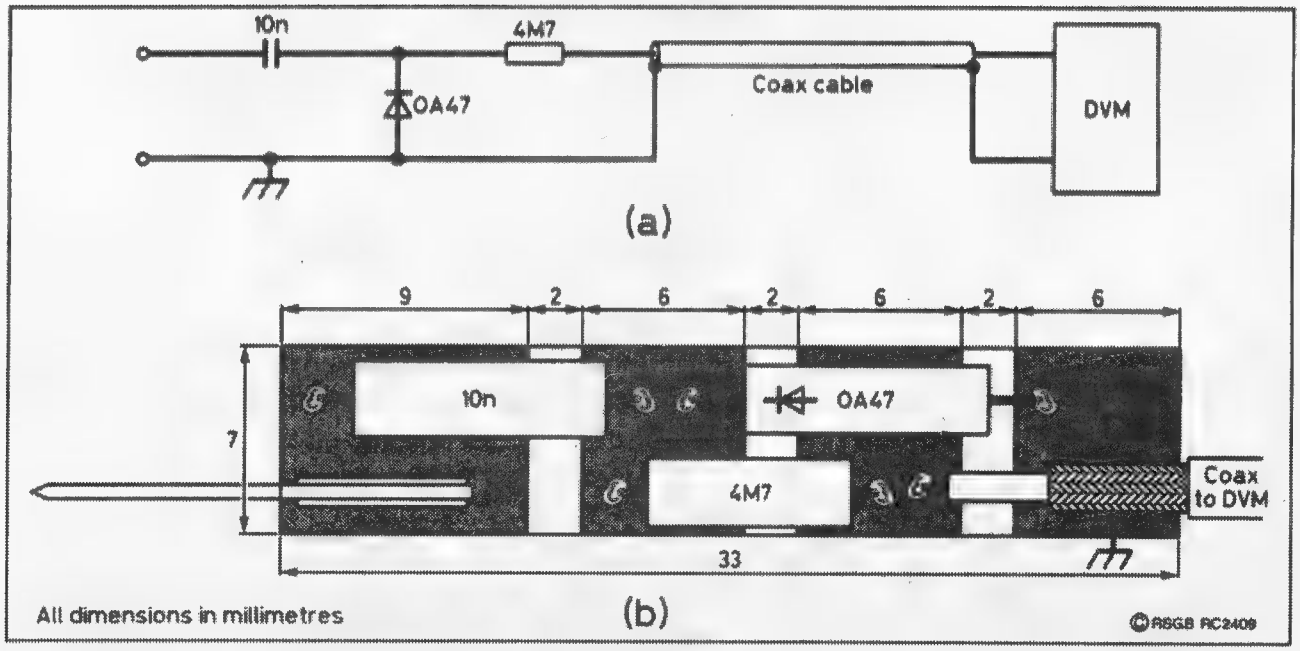

Fig 5. RF Voltmeter Probe.

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should be kept very short to gain the best VHF performance. The circuit board in the original was a piece of single sided laminate with the pads separated using a craft knife. The circuit board was 7mm by 32mm and the circuit was covered with some heat shrink tubing. The diode used was an OA47 but a general purpose Germanium diode would be suitable. The voltage characteristic of a Silicon diode is not ideal for this circuit.

June Fox WIA Federal Office is holding the Magazines with the original diagrams etc.

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Try This

Make LIPDs work for you

by Wally Watkins VK4DO

Living and maintaining a 2.6ha property has its problems while at the same time trying to monitor an Amateur band when away from the shack.

The answer is a LIPD. The November 98 "Silicon chip" magazine had an article entitled *An FM transmitter for musicians* and is available in kit form.

By leaving the microphone out and connecting the receiver output to the line-in terminals, your new LIPD will bring to life the Amateur band of your choice. Using a quarter wave vertical, the signal is Q5 anywhere on the property. A small FM receiver is quite adequate.

The kit is easy to build and if you find a clear spot between 88 and 89 MHz the stability is very good. Even inside the house, monitoring while watching TV etc, is no problem.

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PTT Sound

There are many programs available to allow you to run modes such as CW, RTTY, AMTOR, PACTOR, PSK31, SSTV, FAX, Hellschreiber etc using the sound card in a PC.

One source of such programs on the internet is http://www.muenster.de/~welp/sb.htm. A suitable interface card between the computer and the transceiver appeared in QST November 1999. The article by Salvador Esteban EB3NC had originally appeared in CQ Radio Amateur Spanish Edition August 1998. While you may be able to get away without an interface card it does make operation somewhat simpler.

The card called PTT Sound interfaces the computer serial port and sound card input and output to the transceiver. Levels can be set on the card and microphone input is provided for with a push to talk switch. The card is designed to allow the use of an electret microphone.

The PTT Sound card circuit is shown in Fig 2. The components are relatively non critical. Transistor Q1 could be any low noise NPN audio type. The ECG series are just a series of replacement parts which may be available locally but there are many other local types which would be suitable.

The various input and output levels can be set on the interface card. The jumper J1 can be set for the required PTT input from the computer serial port. This may vary with the software selected. The audio input from the sound card can come from either the left or right channel. The author used the tip or left channel.

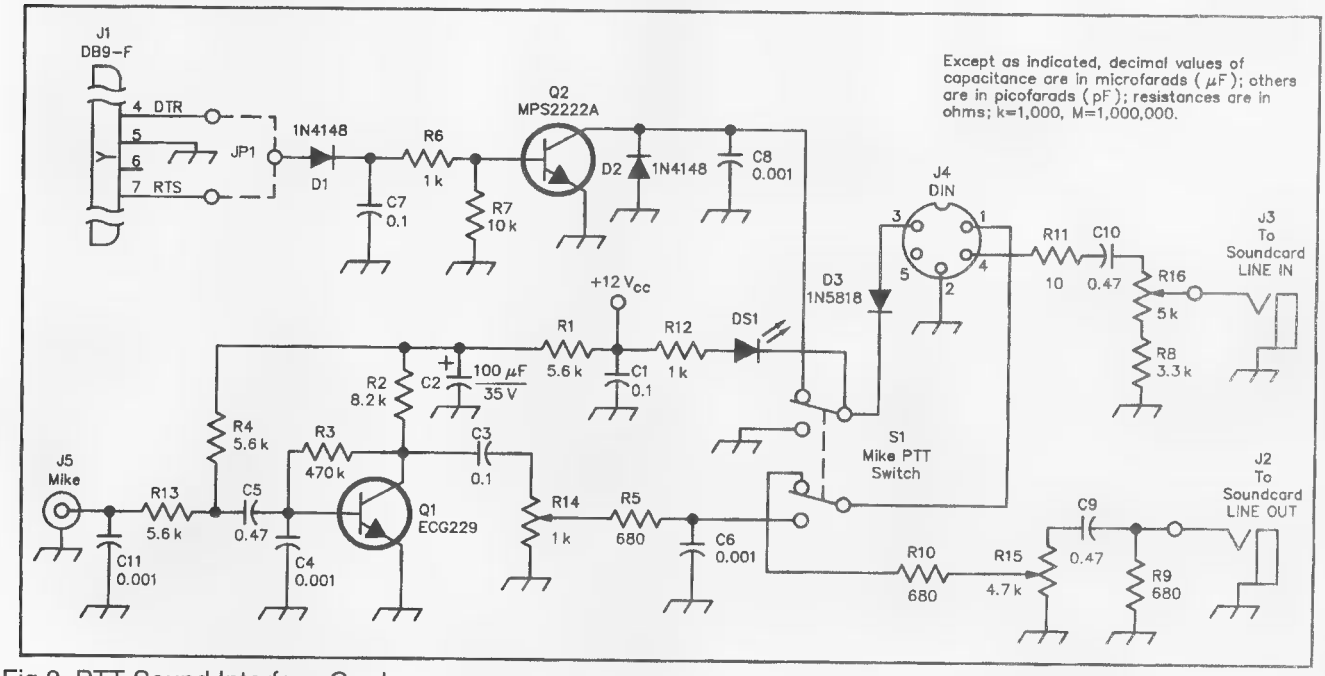

Fig 2. PTT Sound Interface Card.

Erratum

An error occurred in the January 2000 Technical Abstracts which saw the omission of Fig 1. This showed the setup of the original loop described by K Patterson in Electronics Aug 21 1967 and the setup of the AMA loop of Chris Käferlein DK5CZ and Hans Würtz DL2FA originally published in CQ DL Feb and April 1983. These differ in the tuning and matching arrangements. The diagram is shown as Fig 3. which is the original and missing Fig 1 of the Jan 2000 issue.

The diagram comes from the Japanese CQ Ham Radio September 1999 article of JG1UNE.

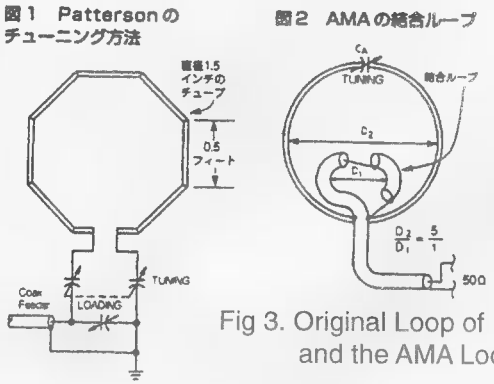

Fig 3. Original Loop of Patterson and the AMA Loop.